

## Ulcerative gastric lesions in Brasileiro de Hipismo horses<sup>□</sup>

*Presencia de lesiones ulcerativas gástricas en caballos Brasileiro de Hipismo*

*Presença de lesões ulcerativas gástricas em cavalos Brasileiro de Hipismo*

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(Received: February 25, 2013; accepted: March 3, 2014)

### Summary

**Background:** equine gastric ulcer syndrome (EGUS) has a high and variable occurrence in horses of different ages and activity levels. **Objective:** the aim of this study was to determine the presence and severity of ulcers in Brasileiro de Hipismo (BH) horses owned by the military police. **Methods:** a group of 80 horses (38 males and 42 females, aged between 3.3 and 29.2 years) performing different activities underwent clinical and gastroscopic evaluation. Descriptive statistics for the presence of ulcers and chi-square ( $X^2$ ) analysis with Fisher exact test were conducted to determine a possible association between EGUS and type of activity, sex or age. **Results:** occurrence of at least one ulcer was detected in 45% of the horses, and most of them (40%) were located in the squamous mucosa of the *Margo plicatus*. No significant association ( $p>0.05$ ) was observed between any of the factors evaluated and the presence of EGUS. **Conclusion:** the BH horses owned by cavalry's military have low incidence of EGUS despite being subjected to stress, which confirms a multifactorial nature of gastric lesions in this subpopulation.

**Keywords:** equine, gastric mucosa, gastroscopy, ulcer.

### Resumen

**Antecedentes:** el Síndrome de Úlcera Gástrica Equina (EGUS) presenta una alta y variable ocurrencia en equinos de diferentes edades y tipo según la actividad que desarrollan. **Objetivo:** determinar la presencia e intensidad de las lesiones ulcerativas gástricas en caballos de la raza Brasileiro de Hipismo (BH) al servicio de la policía militar. **Métodos:** un grupo de 80 equinos (38 machos y 42 hembras) con edades entre 3,3 y 29,2 años, en actividades de adaptación, entrenamiento, patrullaje e inactivos fueron evaluados por examen físico

□ To cite this article: Martínez JR, De Marval CA, Silveira GE. Ulcerative gastric lesions in Brasileiro de Hipismo horses. Rev Colomb Cienc Pecu 2014; 27:211-219.

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y gastroscópico. Se realizaron análisis por estadística descriptiva para porcentaje de ocurrencia de úlceras y análisis de Chi-cuadrado ( $X^2$ ) con test exacto de Fisher para verificar posible asociación entre EGUS, actividad, género y edad. **Resultados:** se determinó una ocurrencia de úlcera del 45%, siendo la mucosa escamosa (40%) la más comprometida en todo el *Margo plicatus*, sin embargo, no hubo asociación significativa ( $p>0,05$ ) entre los factores evaluados y la presencia de EGUS. **Conclusión:** los caballos estudiados presentaron baja incidencia de EGUS a pesar de estar sometidos a situaciones de estrés, confirmando la naturaleza multifactorial de las lesiones gástricas en esta subpoblación de equinos.

**Palabras clave:** equino, gastroscopia, mucosa gástrica, úlcera.

### Resumo

**Antecedentes:** a Síndrome da Úlcera Gástrica Equina (EGUS) apresenta uma ocorrência alta e variável em equinos de diferentes faixas etárias e classes segundo a atividade que desenvolvem. **Objetivo:** determinar a presença e intensidade das lesões ulcerativas gástricas em cavalos da raça Brasileiro de Hipismo (BH) a serviço da polícia militar. Métodos: um grupo de 80 equinos (38 machos e 42 fêmeas), com idade entre os 3,3 e 29,2 anos, desenvolvendo atividades de adaptação, treinamento, patrulhamento e inativos foram avaliados por exame físico e gastroscópicos. Análise por estatística descritiva para taxas de ocorrências de úlceras e análise de Qui-quadrado ( $X^2$ ) com teste de exato Fisher foram realizados para verificar possível associação entre EGUS, atividade, sexo e idade. **Resultados:** foi determinada uma ocorrência de úlcera de 45%, sendo a mucosa escamosa (40%) mais comprometida ao longo do *Margo plicatus*. Entretanto, não houve associação significativa ( $p>0,05$ ) entre os fatores avaliados e a presença de EGUS. **Conclusão:** os cavalos estudados da raça BH apresentaram incidência baixa da EGUS apesar de submetidos a situações de estresse, sinalizando para a natureza multifatorial das lesões gástricas nesta subpopulação de equinos.

**Palavras chave:** equinos, gastroscopia, mucosa gástrica, úlcera.

### Introduction

Equine gastric ulcer syndrome (EGUS) is a common pathology in horses of different ages and it is associated with multiple risk factors. EGUS is considered a cause of reduced performance in equine athletes and other equines assigned to a variety of activities (Nieto *et al.*, 2009; Orsini *et al.*, 2009). Inadequate environmental, nutritional, and management factors may contribute to gastric ulcerative processes, which typically define the multifactorial origin of EGUS. In this respect, risk factors inherent to the animal and the handling system, such as strenuous exercise, inadequate feeding, stress, confinement, use of non-steroidal anti-inflammatory drugs (NSAIDs), and certain bacterial infections have all been associated with the development of EGUS (Lorenzo-Figueras *et al.*, 2002; Videla and Frank, 2009). The intensity or combination of these factors may determine the severity of the ulceration.

EGUS occurrence has been extensively studied and its prevalence ranges between 51 and 90% for competition breeds and high performance horses

(Murray *et al.*, 1996; Nieto *et al.*, 2004; Bezdekova *et al.*, 2005; Jonsson and Egenvall, 2006; Tanzali *et al.*, 2011). Prevalence lower than 58% has been described for leisure, bull catching and show horses, as well as for brood mares (Murray *et al.*, 1989; Wiedner *et al.*, 2008). However, other studies reported higher incidences for similar activities. On the other hand, prevalence above 50% has also been reported for horses out of competition and in apparently normal condition (Videla and Frank, 2009).

Brasileiro de Hipismo (BH) horses are characterized by larger than average size, docile temperament, and skills in saddling, jumping and endurance riding. These horses are also used in military police regiments. Horses used for urban military patrolling are subjected to physical activities depending on their training and age, which generates various chronic stressors over the years. These conditions may cause changes in their gastric health.

Studies on EGUS occurrence in BH horses performing activities typical of a military regiment

(such as adaptation, training and urban patrolling) could not be found in the literature. The aim of this study was to evaluate the presence and intensity of ulcerative gastric lesions in BH horses serving in the military police. In particular, we analyzed possible associations between EGUS and factors such as type of activity, sex and age of the animals.

### Materials and methods

A sample of 80 BH horses (38 castrated males and 42 mares, all aged between 3.3 and 29.2 years) belonging to the Alferes Tiradentes Cavalry Regiment (RCAT) of Minas Gerais Military Police (PMMG) in Belo Horizonte, Brazil, was evaluated by physical and gastroscopy examination. Equines were divided into four groups of 20 animals, according to activity: G1: animals in adaptation (pre-training); G2: animals in dressage (horses in military training); G3: animals in urban patrolling (horses in military exercise); and G4: inactive and retired animals (because of disabling medical conditions or age). The age, weight and body scores are presented in Table 1.

Animal handling and environmental particularities were characterized for each group. Animals in adaptation, dressage and patrolling were kept in confinement and fed Tifton hay (*Cynodon dactylon*) at approximately 1.5% body weight (bw), a commercial concentrate ration offered at 1% bw and split into three daily meals, water and mineral salt was offered *ad libitum*. Animals underwent physical activity on alternate days, depending on the group. The activity per working day lasted two hours for G1 horses, three hours for G2, and six hours for G3. The G4 horses remained

on picket and were fed under the same scheme as the other groups. All animals were vaccinated and subjected to regular control for endo and ectoparasites.

All horses underwent a 12-14h fasting period for solids and 4h for liquids before gastroscopy. After sedation (detomidine, 10 µg/kg/IV) and placement of full-mouth speculum (type *Haussmann*) animals were examined by systematic visualization of the gastric mucosa through a flexible videoendoscope (PortaScope®, 1800PVS, Bradenton, FL, USA) (12 mm diameter, 300 cm length) introduced via the nasal passage. The stomach was inflated with air to improve visibility during endoscopy and water jets were squirted to clean food remnants and improve visibility of the gastric surface. The gastric lesions found were video recorded and scored according to the number of lesions (0-4) and intensity (0-5) as recommended by MacAllister *et al.* (1997) (Table 2). All examinations were conducted by the same team and interpreted using a single-blind method by an endoscopist. This study was approved by the Comitê de Ética em Experimentação Animal da Universidade Federal de Minas Gerais under protocol number 234/09.

### Statistical analysis

Descriptive analysis was used to determine the occurrence rate of ulcers, which were scored according to number (“number score”) and intensity (“severity score”). Chi-square ( $X^2$ ) analysis and Fisher exact test were used to determine significant differences ( $p < 0.05$ ) in the possible association between presence of ulcers and potential risk factors: age, sex and type of activities.

**Table 1.** Distribution of Brasileiro de Hipismo horses according to type of activity and description of experimental groups.

Groups	#/Sex	Age (years)	Body weight (kg)	Body score*
G1: Adaptation	7M/13F	3.45±0.10	454.35±47.16	2.85±0.33
G2: Dressage	9M/11F	4.35±0.10	483.55±39.52	3.07±0.33
G3: Patrolling	9M /1F	12.14±4.31	517.25±32.11	3.27±0.41
G4: Inactive	13M /7F	22.12±6.29	458.7±50.86	2.85±0.61

\*Scale from 1 to 5 according to Spiers (1997). M: male, F: female.

**Table 2.** Description of the scoring method according to MacAllister et al. (1997).

Lesion number score	Description
0	No lesion
1	1-2 localized lesions
2	3-5 localized lesions
3	6-10 localized lesions
4	> 10 lesions or diffuse

Lesion severity score	Description
0	No lesion
1	Superficial lesion
2	Affects deep structures
3	Multiple lesions and variable severity
4	Same as 2 plus hyperemia or crater
5	Same as 4 plus active hemorrhage or blood clot

## Results

All animals were apparently healthy upon physical exam. Gastrosopies were performed uneventfully. The fasting period was appropriate for complete visualization of the non-glandular and most of the glandular mucosa. Although gastric content was found in a small area of the antral region, it was not enough to compromise the inspection. The entire length of the esophagus, *Margo plicatus*, and pyloric region was visualized.

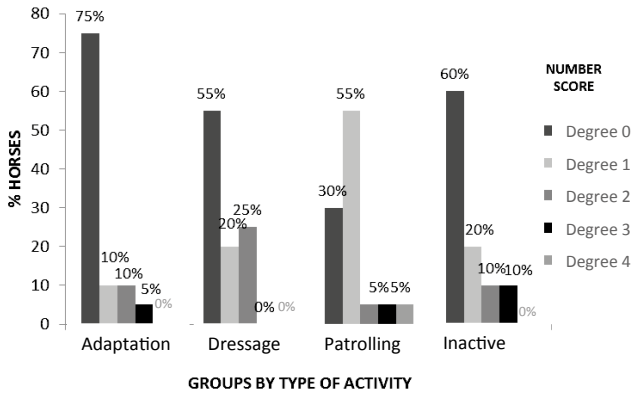
Gastrosopy findings are summarized in Table 3 and Figures 1 and 2. A total of 36/80 (45%) horses had gastric ulcers, 32/80 (40%) of which in the non-glandular mucosa. The score for number of lesions ranged between one (1) and four (4), with the latter having few animals affected (Figure 3). The score for severity of ulcers ranged between one (1) and three (3). Three out of 80 horses (3.7%) had ulcerative lesions in the glandular mucosa with grades one (1) and two (2) for score number and intensity,

**Table 3.** Number and rate of healthy horses and horses suffering from EGUS, according to location of lesions in the non-glandular and/or glandular mucosa and number and severity scores in 80 BH horses.

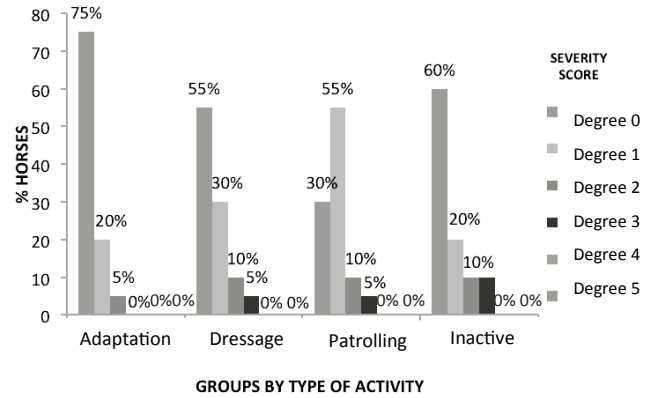
Number Score	Glandular Mucosa	Non-glandular Mucosa	Mucosa Non-gland. and Gland.	Rate (%)
0	-	-	44	55
1	2	18	1	26.25
2	1	9	-	12.5
3	-	4	-	5
4	-	1	-	1.25
Total	3	32	45	80

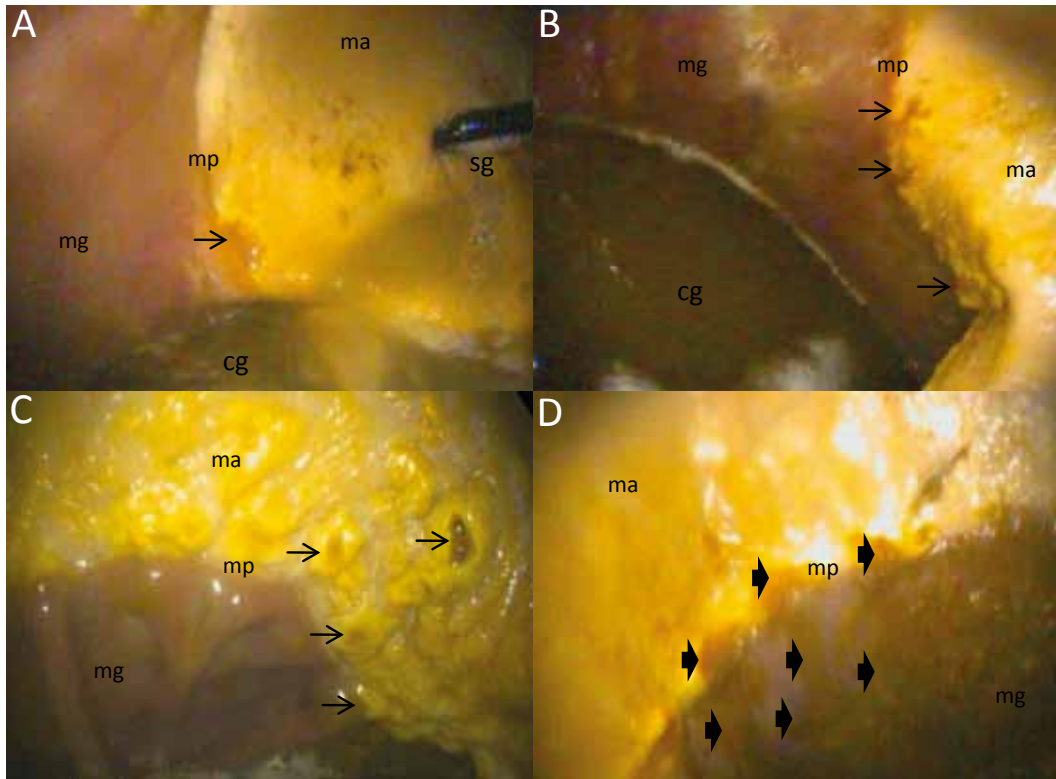
Severity Score	Glandular Mucosa	Non-glandular Mucosa	Non-gland. and Gland. Mucosa	Rate (%)
0	-	-	44	55
1	2	22	1	31.25
2	1	6	-	8.75
3	-	4	-	5
4	-	-	-	-
5	-	-	-	-
Total	3	32	45	80



**Figure 1.** Classification of gastric ulcerative lesions by number score in 80 Brasileiro de Hipismo horses grouped by activity.



**Figure 2.** Classification of gastric ulcerative lesions by severity score in 80 Brasileiro de Hipismo horses grouped by activity.



**Figure 3.** Gastroscopy images of Brasileiro de Hipismo horses under different physical activities. (A) Non-glandular mucosa with an ulcer in the lesser curvature, number and severity score 1, in a horse from the Adaptation group (arrow). (B) Non-glandular mucosa with ulcers in the *Margo plicatus*, number and severity score 1 in a horse from the Dressage group (arrows). (C) Gastric mucosa with ulcers in the greater curvature, number and severity score 2 in a horse from the Patrolling group (arrows). (D) Non-glandular and glandular mucosa with ulcers number and severity score 2 in a horse from the Inactive group (bigger arrows). Non-glandular mucosa (ma), glandular mucosa (mg), *Margo plicatus* (mp), gastric content (cg), gastroscopy probe in retroflexion (sg).

respectively. Only one horse presented grade 1 lesions in both types of mucosa and these were mainly located in the lesser and greater curvature of both mucosal regions adjacent to the *Margo plicatus*. No lesions were found in the esophagus or pyloric area.

The endoscopy findings by groups showed a greater number of horses (14/20) in G3 suffering from ulcerative lesions, with number score from one (1) to four (4) and severity score from one (1) to three (3). G1 had the lowest number of animals affected

(5/20) with a number score equal or lower than three ( $\leq 3$ ). G1 and G4 had 9/20 and 8/20 animals with ulcers, respectively. G4 had more animals with severity scores 2 and 3. No significant associations were found ( $p > 0.05$ ) between gastric ulcers and type of activity ( $p = 0.086$ ), sex ( $p = 0.10$ ), or age ( $p = 0.07$ ).

## Discussion

Studies on the prevalence and incidence of gastric ulcerative lesions in equines have highlighted some of the limitations of gastroscopy to estimate the degree of mucose damage in EGUS (Andrews *et al.*, 2002). In spite of the fasting period, presence of remaining food in few places of the glandular area did hamper the evaluation of possible lesions in that area. Such difficulty was not encountered in the non-glandular mucosa. In this study we found low presence of lesions in the mucose area, which is in agreement with Buchanan and Andrews (2003), Videla and Frank (2009), and Tamzali *et al.* (2011).

The interpretation of lesion number and intensity in terms of clinical relevance is another source of discrepancy in the statistics of EGUS prevalence and incidence for some horse populations. Jeune *et al.* (2009) and Luthersson *et al.* (2009a) consider grades 0 and 1 as normal, although ulcer intensity is not necessarily correlated with clinical signs (Murray *et al.*, 1989). Moreover, changes in the weather, breed, handling, and activities performed by the horses have contributed to those discrepancies (Jonsson and Egenvall, 2006).

The general incidence of EGUS in our study was 45%, a percentage that falls within the estimated rates for horses considered not overly stressed or in low physical demand, such as leisure, show, and exhibition horses (Murray *et al.*, 1989; Bezdekova *et al.*, 2005; McClure *et al.*, 2005; Wiedner *et al.*, 2008; Luthersson *et al.*, 2009b). This incidence could fall to 19% if we neglected the relevance of the injuries classified as score 1; therefore, the incidence would be even lower than expected for this category.

It has been suggested that military cavalry horses are exposed to many stressors, as evidenced by Leal *et al.* (2011), who found differences in plasma cortisol concentration. This leads to behavioral changes in animals in confinement or in military regiment

(Rezende *et al.*, 2006; Muñoz *et al.*, 2009), evidencing a close relation between stereotypy and gastric health (Moeller *et al.*, 2008; Wickens and Heleski, 2010; Hemmann *et al.*, 2012). This is why the hypothesis of high EGUS occurrence in the studied population was suggested.

The low incidence of ulcerations in this study suggests the predominance of gastric mucosa protective factors over other harmful factors, such as the stress derived from physical activities. Possibly, the feed handling provided to these horses counteracted the caustic action of gastric juice, as shown by De Graaf-Roelfsema *et al.* (2010). They concluded that stress from exercise is not important in EGUS development compared to environmental changes and feeding management since no increase in EGUS incidence was observed for properly fed horses under strenuous training. However, the multifactorial nature of this syndrome may involve other factors that were not considered.

Dietary management contributes positively to practical prevention strategies, treatment, and decreased recurrences of EGUS (Reese and Andrews, 2009). In this study, dietary management favored a relatively low incidence of ulceration, despite the excess concentrate feed/body weight ratio usually recommended (0.5 kg/100 kg; Nadeau *et al.*, 2000). This indicates that, in addition to the ratio between fiber and concentrate, the frequency and type of feeding has a strong influence in gastric health (De Graaf-Roelfsema *et al.*, 2010), and three meals per day was apparently adequate. Additionally, it is important to take into consideration that dietary fiber helps maintain a healthy gastric mucosa, therefore, providing greater amounts of forage to horses with EGUS or putting them out to pasture should be part of any therapeutic strategy.

Studies with different breeds in Brazil have shown a 47.6% prevalence in asymptomatic adult horses in stalls and pasture (Fernandes *et al.*, 2003). Belli *et al.* (2005) reported 75% prevalence in hospitalized horses with presumptive diagnosis of EGUS. A preliminary study on horses performing common activities reported EGUS prevalence between 46.5 and 77.91%, showing a significant association between presence of gastric lesions and type of activity (Berger *et al.*,

2009). Regarding Brasileiro de Hipismo horses kept at military regiments, prevalence studies identifying and comparing factors that induce gastric lesions could not be found. The EGUS incidence found in this study is low compared with other horse breeds.

Regarding location of ulcerative lesions, we found that the non-glandular mucosa was the most compromised area, particularly in proximity of the *Margo plicatus*, coinciding with existing literature (Hammond *et al.*, 1986; Vatistas *et al.*, 1999; Murray *et al.*, 1989; Luthersson *et al.*, 2009b; Tamzali *et al.*, 2011). On the other hand, the low presence of ulcers in the glandular and both mucosae simultaneously contrasts with a report by Luthersson *et al.* (2009a). This suggests a difference in the efficiency of mucosae's self-protection mechanisms, which are more relevant than harmful mechanical factors, such as type of physical activity, regarding the appearance of gastric ulcers. Lesions in the glandular mucosa may be related to the use of NSAIDs. The medical records did not show any recent use of these drugs in the studied animals, which might explain the low presence of lesions in this gastric region.

The lack of association between lesion incidence and the studied factors (i.e., type of activity, sex and age) agrees with results from other studies (Bell *et al.*, 2007; Tamzali *et al.*, 2011). Nevertheless, some other studies have shown their involvement, thus they are considered to be risk factors for the onset of this syndrome (Lorenzo-Figueras and Merrit, 2002; Orsini *et al.*, 2009). Geriatric and castrated male horses have shown greater susceptibility to EGUS (Rabuffo *et al.*, 2002). This was not evidenced in the present study, in which all males were castrated and did not show greater occurrence when compared to females. Regarding age, specimens 3 to 29 years old were evaluated, and our results are in disagreement with other reports (Chameroy *et al.*, 2006; Jonsson and Egenvall, 2006). There was a tendency for more animals with number scores between grades 2 and 3 in the retired horses, in agreement with Luthersson *et al.* (2009b). These findings demonstrate the influence of factors related to management and the environment in the incidence of the syndrome.

The majority of gastropathies in the patrolling horses can be explained by the stress suffered during

transportation to patrol urban areas. In addition, these horses were used to patrol a large urban area (330 km<sup>2</sup>) three times a week, a factor that may also predispose them to develop gastric ulcers (McClure *et al.*, 2005). However, there was no statistical association between the studied variables. In spite of the fact that the retired horses remained unleashed, apparently it did not benefit the gastric mucosa integrity in comparison with the partially confined animals, which is contrary to the results of other studies (Husted *et al.*, 2009; Jeune *et al.*, 2009). This could be explained by the cumulative effect of age and previous medical occurrences that disabled these horses for regular activities.

The activities endured during adaptation, training and working by cavalry military horses do not seem to be related with the occurrence of gastropathies. This also suggests a concomitant involvement of other potentially ulcerogenic factors and the need to control them (Luthersson *et al.*, 2009b; De Graaf-Roelfsema *et al.*, 2010; Flores *et al.*, 2011). Because of the lack of information on gastric changes in Brasileiro de Hipismo horses, it is important to undertake further research to elucidate the involvement of factors inherent to the individual and the environment, as well as the relationship between welfare and gastric health in animals showing low EGUS prevalence without clinical signs.

### Acknowledgments

The authors acknowledge Mr. Walmir Santos Viana for allowing us to conduct this study at RCAT-PMMG in Belo Horizonte. Funding for this study was provided by CNPq, CAPES / PEC-PG – Brazil, the University of Antioquia (Colombia), and UFMG (Brazil).

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